

AMENDMENTS

In the Claims

The following listing, if entered, replaces all prior versions of the claims in the present application.

1. (Previously Presented) A method comprising:

replicating data from a first volume to a second volume, wherein

the replicating comprises copying to the second volume only data from regions of the first volume that are modified by application-driven update operations, and

the application-driven update operations are initiated by an application managing data in the first volume;

while the replicating the data from the first volume is being performed, detecting a change to a first region of the first volume, wherein

the change is caused by a restore operation to restore the first volume from a third volume,

the restore operation is not an application-driven update operation initiated by the application,

the change is detected by detecting the restore operation and accessing a restoration data structure,

the restoration data structure identifies regions of the first volume that are not synchronized with the third volume, and

the change to the first region caused by the restore operation is not designated for replication from the first volume to the second volume at the time of the detecting;

in response to the detecting, adding information identifying the first region to a replication data structure, wherein

the adding comprises combining the replication data structure with the restoration data structure,

the replication data structure identifies regions of the first volume that are designated for replication to the second volume,  
the regions of the first volume designated for replication to the second volume are regions of the first volume that are modified by application-driven update operations and the first region of the first volume changed by the restore operation, and  
the adding is performed while the replicating is being performed; and  
in response to the adding the information to the replication data structure, replicating data modified by the restore operation from the first region of the first volume to the second volume, wherein  
the replicating the data from the first region is performed while the replication of the data modified by the application-driven update operations from the first volume is ongoing, and  
the replicating the data from the first volume, the detecting, the adding, and the replicating the data from the first region are performed by a computing device implementing a replication facility.

2. (Cancelled)

3. (Previously Presented) The method of claim 1 wherein the third volume is a snapshot of the first volume at one point in time.

4. – 9. (Cancelled)

10. (Previously Presented) The method of claim 1 wherein the first volume is accessible by the application during the replicating.

11. (Previously Presented) The method of claim 1 wherein the first volume is accessible by the application while being restored from the third volume.

12. – 13. (Cancelled)

14. (Previously Presented) A system comprising:

a processor;

computer-implemented means for replicating data from a first volume to a second

volume, wherein

the replicating comprises copying to the second volume only data from regions of

the first volume that are modified by application-driven update operations,

and

the application-driven update operations are initiated by an application managing

data in the first volume;

computer-implemented means for detecting a change to a first region of the first volume

while the data is being replicated from the first volume, wherein

the change is caused by a restore operation to restore the first volume from a third

volume, and

the restore operation is not an application-driven update operation initiated by the application,

the change is detected by detecting the restore operation and accessing a

restoration data structure,

the restoration data structure identifies regions of the first volume that are not

synchronized with the third volume, and

the change to the first region caused by the restore operation is not designated for

replication from the first volume to the second volume at the time of the

detecting;

computer-implemented means for, in response to detection of the change, adding

information identifying the first region to a replication data structure, wherein

the information is added to the replication data structure by combining the

replication data structure with the restoration data structure,

the replication data structure identifies regions of the first volume that are

designated for replication to the second volume,

the regions of the first volume designated for replication to the second volume are

regions of the first volume that are modified by application-driven update

operations and the first region of the first volume changed by the restore

operation, and

the information is added while the data is being replicated from the first volume;  
and  
computer-implemented means for, in response to the addition of the information,  
replicating data modified by the restore operation from the first region of the first  
volume to the second volume, wherein  
the data from the first region is replicated while the data modified by the  
application-driven update operations is being replicated from the first  
volume.

15. – 16. (Cancelled)

17. **(Currently Amended)** A system comprising:

a processor; and

a memory coupled to the processor, wherein the memory stores program instructions  
executable by the processor to implement a replication facility, and wherein the  
replication facility is configured to:

replicate data from a first volume to a second volume by copying to the second  
volume only data from regions of the first volume that are modified by  
application-driven update operations, wherein

the application-driven update operations are initiated by an application  
managing data in the first volume;

while data from the first volume is being replicated, detect a change to a first  
region of the first volume, wherein

the change is caused by a restore operation to restore the first volume from  
a third volume,

the restore operation is not an application-driven update operation initiated  
by the application,

the change is detected by detecting the restore operation and accessing a  
restoration data structure,

the restoration data structure identifies regions of the first volume that are  
not synchronized with the third volume, and

the change to the first region caused by the restore operation is not

designated for replication from the first volume to the second volume at the time of the detecting;

in response to detection of the change, add information identifying the first region to a replication data structure, wherein  
the information is added to the replication data structure by combining the replication data structure with the restoration data structure,  
the replication data structure identifies regions of the first volume that are designated for replication to the second volume,  
the regions of the first volume designated for replication to the second volume are regions of the first volume that are modified by application-driven update operations and the first region of the first volume changed by the restore operation, and  
the information is added while the data from the first volume is being replicated; and

in response to the addition of the information, replicate data modified by the restore operation from the first region of the first volume to the second volume, wherein  
the data modified by the ~~application-drive update~~ restore operation[[s]] from the first region is replicated while the data is being replicated from the first volume.

18. – 20. (Cancelled)

21. (Previously Presented) A computer-readable storage medium comprising program instructions executable to:

replicate data from a first volume to a second volume by copying to the second volume only data from regions of the first volume that are modified by application-driven update operations, wherein  
the application-driven update operations are initiated by an application managing data in the first volume;  
while data from the first volume is being replicated, detect a change to a first region of the first volume, wherein

the change is caused by a restore operation to restore the first volume from a third volume,  
the restore operation is not an application-driven update operation initiated by the application,  
the change is detected by detecting the restore operation and accessing a restoration data structure,  
the restoration data structure identifies regions of the first volume that are not synchronized with the third volume, and  
the change to the first region caused by the restore operation is not designated for replication from the first volume to the second volume at the time of the detecting;  
in response to detection of the change, add information identifying the first region to a replication data structure, wherein  
the information is added to the replication data structure by combining the replication data structure with the restoration data structure,  
the replication data structure identifies regions of the first volume that are designated for replication to the second volume,  
the regions of the first volume designated for replication to the second volume are regions of the first volume that are modified by application-driven update operations and the first region of the first volume changed by the restore operation, and  
the information is added while the data from the first volume is being replicated; and  
in response to the addition of the information, replicate data modified by the restore operation from the first region of the first volume to the second volume, wherein  
the data from the first region is replicated while the data modified by the application-driven update operations is being replicated from the first volume.

22. – 24. (Cancelled)

25. (Previously Presented) The method of claim 1, wherein the replication data structure comprises a log.
26. (Previously Presented) The method of claim 1, wherein  
the replication data structure comprises a replication bitmap,  
the restoration data structure comprises a restoration bitmap, and  
the replication data structure is combined with the restoration data structure by  
performing a logical OR operation to combine the replication bitmap with  
the restoration bitmap.
27. (Cancelled)
28. (Previously Presented) The method of claim 1, further comprising:  
detecting a change to a second region of the first volume, wherein  
the change to the second region is caused by the restore operation, and  
the change to the second region is not being tracked; and  
causing the restore operation to fail, in response to the detecting.
29. (Previously Presented) The system of claim 17, wherein the replication data structure comprises a log.
30. (Previously Presented) The system of claim 17, wherein  
the replication data structure comprises a replication bitmap,  
the restoration data structure comprises a restoration bitmap, and  
the replication data structure is combined with the restoration data structure by  
performing a logical OR operation to combine the replication bitmap with  
the restoration bitmap.
31. (Cancelled)
32. (Previously Presented) The system of claim 17, wherein the replication facility is configured to:  
detect a change to a second region of the first volume, wherein

the change to the second region is caused by the restore operation, and  
the change to the second region is not being tracked; and  
cause the restore operation to fail, in response to detecting the change to the second  
region at a time at which the second region is not being tracked.

33. (Previously Presented) The computer readable storage medium of claim 21, wherein  
the replication data structure comprises a log.

34. (Previously Presented) The computer readable storage medium of claim 21, wherein  
the replication data structure comprises a replication bitmap,  
the restoration data structure comprises a restoration bitmap, and  
the replication data structure is combined with the restoration data structure by  
performing a logical OR operation to combine the replication bitmap with  
the restoration bitmap.

35. (Cancelled)

36. (Previously Presented) The computer readable storage medium of claim 21, wherein  
the program instructions are executable to:  
detect a change to a second region of the first volume, wherein  
the change to the second region is caused by the restore operation, and  
the change to the second region is not being tracked; and  
cause the restore operation to fail, in response to detecting the change to the second  
region at a time at which the second region is not being tracked.